REMARKS

Claims 1-21 and 40-54 are pending in the application with claims 1-4, 6-16, and 18-21 amended herein and new claims 40-54 added herein.

Claims 8-21 stand rejected under 35 U.S.C 112, second paragraph, as being indefinite. Without admitting to the propriety of such rejection, Applicants herein amend claims 8, 13, and 18 removing "electronic device" from the preamble. Applicants request withdrawal of the indefiniteness rejection in the next Office Action.

Claims 1-21 stand rejected under 35 U.S.C.103(a) as being unpatentable over Suntola alone or in combination with Yu. Applicants traverse and request reconsideration.

Amended claim 1 sets forth an interface forming method that includes, among other features, forming a first layer containing a first metal, chemisorbing on the first layer an interface layer containing at least one monolayer of the first metal intermixed with a second metal different from the first metal, and forming a second layer containing the second metal on the interface layer. Page 3 of the Office Action acknowledges that Suntola is silent regarding forming the interface layer between the first layer and the second layer. However, the Office asserts that those of ordinary skill would have a reasonable expectation of achieving similar results regardless of whether or not the compound layer was formed on a substrate or on the first layer.

Applicants assert that the Office's allegation apparently fails to recognize the relationship between the composition of the first layer, the interface layer, and the second layer expressly set forth in claim 1. That is, it is an advantage of the interface

forming method of claim 1 that the interface layer contains a metal in common with the first layer as well as another different metal in common with the second layer. Such a feature provides the adhesion and other interfacial property advantages described in the present specification at page 9, line 5 to page 10, line 13 and page 14, lines 3-22. Claim 1 sets forth an interface layer the composition of which is at least in part dictated by the composition of the first layer and the second layer. By contrast, Suntola does not contemplate any such interface layer.

Page 3 of the Office Action merely states that those of ordinary skill would have a reasonable expectation of achieving similar results regardless of whether the interface layer was formed on a substrate or on a deposited film. Clearly, such a statement fails to give weight to the express terms of claim 1 and to view the claim as a whole, as required. Suntola does not provide any disclosure or suggestion of linking the composition of an interface layer with the compositions of a first and second layer, as set forth in claim 1. Further, Suntola does not disclose or suggest any interface layer providing the advantages that are realized by using the interface layer of claim 1. A finding of obviousness requires disclosure or suggestion of every element. Suntola clearly fails in this regard and cannot be considered to alone render claim 1 unpatentable as alleged by the Office.

Page 3 of the Office Action further alleges that claim 1 is unpatentable over Suntola in combination with Yu. The Office relies upon Yu as allegedly teaching an interface layer containing barium, silicon, and oxygen. However, Applicants note that Yu does not disclose or suggest a first layer containing a first metal and an interface

layer also containing the first metal. Instead, the interface layer of Yu is only formed on a silicon substrate. Such fact is clearly stated in column 2, lines 16-18 and elsewhere throughout Yu. As can be readily appreciated from the discussion in column 2, line 15 to column 3, line 29, the success of forming the interface 14 of Yu depends upon the physical and chemical properties of the underlying silicon substrate and the reaction thermodynamics between silicon, alkaline-earth-metal, and oxygen.

Nowhere within the text of Yu is any suggestion provided that a reasonable expectation of success exists in attempting to form interface 14 on some surface other than a silicon substrate. Yu does not provide any description of process modifications that might be affected to adapt interface 14 to some other surface. Applicants assert that interface 14 containing alkaline-earth-metal, silicon, and oxygen is uniquely adapted to formation on a silicon substrate and the disclosure of Yu is limited to such use. Reference to claim 1 of Yu and its remaining claims further support the Applicants' assertions. At least for such reason, Yu cannot be considered to disclose every element of claim 1.

As asserted, neither Suntola nor Yu disclose or suggest a method that includes forming a first layer containing a first metal and chemisorbing on the first layer an interface layer containing at least one monolayer of the first metal intermixed with a second metal. Since both references are similarly deficient, combination of the references cannot be considered to disclose or suggest the missing feature. At least for such reason, claim 1 is patentable over Suntola considered alone or in combination with Yu.

Claims 2-7 and 40-45 depend from claim 1 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested. For example, claim 41 sets forth that the chemisorbing includes atomic layer depositing. Even though Suntola describes atomic layer depositing (epitaxy), such reference does not disclose or suggest atomic layer depositing an interface layer having the composition set forth in claim 1. In addition, Yu does not provide any mention of atomic layer depositing. Yu also does not mention forming an interface layer having the composition set forth in claim 1. Accordingly, Yu cannot be considered to describe atomic layer depositing the interface of claim 41.

Also for example, claim 42 sets forth that the first metal is selected from the group consisting of Pt and Ru. Accordingly, the method thus includes forming a first layer comprising Pt or Ru and chemisorbing on the first layer an interface layer containing at least one monolayer of Pt or Ru intermixed with a different second metal. Neither Suntola nor Yu disclose or suggest the subject matter of claim 42.

Page 4 of the Office Action states that the claimed method is not "material critical" in that those of ordinary skill would have a reasonable expectation of success regardless of the specific materials chosen. Applicants traverse such allegation at least for the reasons described above. That is, Yu is confined in its disclosure to forming a silicon-containing interface on a silicon substrate. Yu does not provide any teaching or suggestion that would allow those of ordinary skill to apply the Yu process to forming an interface layer having the composition set forth in claim 1. Claim 42 further limits the composition of claim 1 by specifying that the first metal is Pt or Ru. Yu is thus asserted

by the Applicants to be even further removed from the subject matter of claim 42 by virtue of the clear absence of teachings allowing adaptation of the Yu process to a first layer containing Pt or Ru and an interface layer also containing Pt or Ru. Suntola further does not provide any disclosure or suggestion of such features of claim 42.

Similarly, claim 44 sets forth that the first layer consists of Pt or Ru. Claim 45 sets forth that the second layer consists of barium strontium titanate, lead zirconate titanate, or Ta_2O_5. As may be appreciated from the discussion above regarding the deficiencies of the cited art as to claim 42, claims 44 and 45 are also patentable.

Amended claim 8 sets forth an interface forming method that includes, among other features, forming an electronic device interface layer between and in contact with a first layer containing a first metal and a second layer containing a second metal different from the first metal. The interface layer is formed separately from forming the first and second layers, contains the first and second metals, and does not substantially contain a material from the first or second layers as separately formed. As may be appreciated from the discussion above regarding the deficiencies of the cited art as to claim 1, claim 8 is also patentable. Claims 9-12 depend from claim 8 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Amended claim 13 sets forth an interface forming method that includes, among other features, forming a first electronic device layer that includes a first metal, chemisorbing a first portion of at least one monolayer over the first layer, and chemisorbing a second portion of the at least one monolayer over the first layer. The

first portion contains the first metal, the second portion contains a second metal different from the first metal, and the first and second portions are comprised by an interface layer. The method includes forming a second electronic device layer containing the second metal on the interface layer. As may be appreciated from the discussions above regarding the deficiencies of the cited art as to claim 1, claim 13 is also patentable. Claims 14-17 depend from claim 13 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Amended claim 18 sets forth an interface forming method that includes, among other features, forming a first electronic device layer containing a first metal, chemisorbing a first unsaturated interface layer containing the first metal on the first device layer, and chemisorbing a second unsaturated interface layer on the first device layer in areas not saturated by the first interface layer. The second interface layer contains a second metal different from the first metal. The method includes forming a second electronic device layer containing the second metal on the first and second interface layers.

Page 3 of the Office Action alleges that Suntola discusses partial coverage of a substrate during atomic layer epitaxy. However, claim 18 expressly sets forth using the concept of unsaturated chemisorption to provide a second metal in the interface layer that is also comprised by a subsequently formed second electronic device layer. Such an approach provides the advantages discussed above and in the present specification. By comparison, Suntola does not disclose or suggest every element of claim 18 by

failing to describe how the concept of partial coverage may be used to an advantage (the compositional relationship of the second electronic device layer to the second unsaturated interface layer, as claimed). Yu fails to disclose or suggest every element of claim 18 at least for the reasons that can be appreciated from the discussion above regarding Yu's deficiencies as to claim 1. Claims 19-21 depend from claim 18 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

New claim 46 sets forth an interface forming method that includes, among other features, forming a first layer containing a first chemical element and chemisorbing on the first layer an interface layer containing at least two monolayers. The interface layer contains the first chemical element intermixed with a second chemical element different from the first chemical element to provide a composition gradient across a thickness of the interface layer. The method includes forming a second layer containing the second chemical element on the interface layer. The subject matter of claim 46 is supported at least by page 15, line 9 to page 16, line 2 of the present specification. Applicants assert that neither Suntola nor Yu disclose or suggest chemisorbing an interface layer such as set forth in claim 46 to provide a composition gradient across a thickness of the interface layer.

Claims 47-54 depend from claim 46 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested. For example, claim 47 sets forth that the chemisorbing includes increasing a composition ratio of the second chemical element to the first chemical element as the thickness of

the interface layer increases. Neither Suntola nor Yu provide any discussion of the subject matter of claim 47. Similarly, Applicants note that claim 40 depending from claim 1 sets forth that the interface layer of claim 1 contains at least two monolayers and that the chemisorbing of claim 1 includes providing a composition gradient across a thickness of the interface layer by increasing a composition ratio of the second metal to the first metal as the thickness of the interface layer increases. Accordingly, claim 40 is also patentable over the cited references.

Further, for example, claim 48 depends from claim 46 and sets forth that an innermost portion of the interface layer proximate the first layer exhibits a first composition ratio of the first to the second chemical element. An outermost portion of the interface layer proximate the second layer exhibits a second composition ratio of the first to the second chemical element. The first ratio is greater than the second ratio. Neither Suntola nor Yu provide any disclosure or suggestion of the subject matter of claim 48.

Applicants herein provide adequate reasons supporting allowance of claim 1-21 and 40-54. Applicants request allowance of all pending claims in the next Office Action.

Respectfully submitted,

Dated: 16 Dec 2002 By: _____

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Group Art Unit.....1762
Examiner ..... B. Talbot
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Title: Mixed Composition Interface Layer and Method of Forming

VERSION WITH MARKINGS TO SHOW CHANGES MADE ACCOMPANYING RESPONSE TO SEPTEMBER 12, 2002 OFFICE ACTION

In the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

1. (amended) An interface forming method comprising:

forming a first layer comprising a first ~~chemical element~~ metal;

chemisorbing on the first layer an interface layer comprising at least one monolayer of the first ~~chemical element~~ metal intermixed with a second ~~chemical element~~ metal different from the first ~~chemical element~~ metal; and

forming a second layer comprising the second ~~chemical element~~ metal on the interface layer.

2. (amended) The method of claim 1 wherein the first layer does not substantially comprise the second ~~chemical element~~ metal.

3. (amended) The method of claim 2 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

4. (amended) The method of claim 1 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

6. (amended) The method of claim 1 wherein the first layer comprises a first metal other than Ta and the second layer comprises Ta_2O_5.

7. (amended) The method of claim 6 wherein the first metal comprises Pt.

8. (amended) An ~~electronic device~~ interface forming method comprising forming an electronic device interface layer between and in contact with a first layer comprising a first ~~chemical element~~ metal and a second layer comprising a second ~~chemical element~~ metal different from the first ~~chemical element~~ metal, the interface layer being formed separately from forming the first and second layers, comprising the first and second ~~chemical elements~~ metals, and not substantially comprising material from the first or second layers as separately formed.

9. (amended) The method of claim 8 wherein the first layer does not substantially comprise the second ~~chemical element~~ metal.

10. (amended) The method of claim 9 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

11. (amended) The method of claim 8 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

12. (amended) The method of claim 8 wherein the interface layer comprises at least one monolayer of intermixed first and second ~~chemical elements~~ metals chemisorbed on the first layer.

13. (amended) An ~~electronic device~~ interface forming method comprising:

forming a first electronic device layer comprising a first ~~chemical element~~ metal;

chemisorbing a first portion of at least one monolayer over the first layer, the first portion comprising the first ~~chemical element~~ metal;

chemisorbing a second portion of the at least one monolayer over the first layer, the second portion comprising a second ~~chemical element~~ metal different from the first ~~chemical element~~ metal and the first and second portions of the at least one monolayer being comprised by an interface layer; and

forming a second electronic device layer comprising the second ~~chemical element~~ metal on the interface layer.

14. (amended) The method of claim 13 wherein the first layer does not substantially comprise the second ~~chemical element~~ metal.

15. (amended) The method of claim 14 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

16. (amended) The method of claim 13 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

18. (amended) An ~~electronic device~~ interface forming method comprising:

forming a first electronic device layer comprising a first ~~chemical element~~ metal;

chemisorbing a first unsaturated interface layer comprising the first ~~chemical element~~ metal on the first device layer, the first interface layer having a thickness of from about 1 to about 10 monolayers;

chemisorbing a second unsaturated interface layer at least on the first device layer in areas not saturated by the first interface layer, the second interface layer comprising a second ~~chemical element~~ metal different from the first ~~chemical element~~ metal and having a thickness of from about 1 to about 10 monolayers; and

forming a second electronic device layer comprising the second ~~chemical element~~ metal on the first and second interface layers.

19. (amended) The method of claim 18 wherein the first layer does not substantially comprise the second ~~chemical element~~ metal.

20. (amended) The method of claim 19 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

21. (amended) The method of claim 18 wherein the second layer does not substantially comprise the first ~~chemical element~~ metal.

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